REMARKS

Claims 1-11 and 13-36 are pending in the present application.

In the office action mailed December 1, 2004 (the "Office Action"), claims 13 and 14 were objected to for informalities and claims 1-11 and 13-36 were rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,697,063 to Zhu (the "Zhu patent).

Claims 13 and 14 have been amended to correct the claim dependency. The Examiner's objection to claims 13 and 14 should now be withdrawn.

Turning to the rejection of the claims under 35 U.S.C. 102(e), the Zhu patent is directed to a graphics rendering pipeline that utilizes screen space tiling (SST) to improve memory bandwidth utilization for frame buffer accesses. The rendering pipeline further utilizes a double-z rendering scheme to decouple scan conversion/depth buffer processing from the rasterization/shading process. As described in the Zhu patent, SST partitions a screen into disjoint rectangular regions called tiles. Geometries in screen space are binned into tiles that the geometries intersect with primitives crossing multiples tiles binned in all the relevant tiles. An example of SST is described with reference to Figure 3, which includes a description of a binning process used in the rendering pipeline.

The Zhu patent further describes various embodiments of anti-aliased multipass rendering. A first anti-aliasing scheme directly composites the color contribution of individual passes of fragments into the color buffer. A second anti-aliasing scheme merges color contribution from all passes for each fragment into one color, and then composites that color value with the value in the corresponding color buffer location. The Zhu patent further describes an anti-aliasing scheme that combines two anti-aliasing schemes. More specifically, an upper limit is put in place on the number of fragments that are stored in the multipass buffer. Whenever, the number of fragments exceeds the buffer size of the multipass buffer, multi-pass merging is deactivated and compositing of the fragments then takes place in the color buffer. As a result, the second anti-aliasing scheme is utilized until the number of fragments fills the multipass buffer, at which the first anti-aliasing scheme is then utilized.

In the method described in the Zhu patent, visibility information is combined with the tile geometries for each tile of the SST so that only visible geometries are set up for rasterization. That is, only visible fragments are fully rasterized and shaded. The visible fragments of each tile are sent to a blending engine for alpha blending of the incoming

fragments. That is, the visible fragments of each tile are alpha blended in order to resolve and output pixel colors into a frame buffer.

Claims 1, 10, and 18 are not anticipated by the Zhu patent because the Zhu patent fails to disclose the combinations of limitations recited by the respective claims.

Claim 1 recites method for calculating values for pixels of an image comprising transforming the geometric primitives from a first coordinate space to a second coordinate space; selecting a first transformed primitive from the transformed primitives in the second coordinate space; without shifting any of the other transformed primitives, shifting the first transformed primitive in the second coordinate space by a first sub-pixel offset from a first pixel position to a first sub-pixel position; rendering the first shifted primitive at the first sub-pixel position to generate values for a first set of pixels for the first shifted primitive; shifting the first transformed primitive in the second coordinate space by a second sub-pixel offset from the first pixel position to a second sub-pixel position; rendering the first shifted primitive at the second sub-pixel position to generate values for a second set of pixels for the first shifted primitive; and combining the values for the first and second sets of pixels for the first transformed primitive to determine values for a resultant set of pixels for the first transformed primitive that are included in the pixels of the image.

Claim 10 recites a method for calculating values for pixels of an image comprising reading the geometric data; setting-up the geometric primitives into a scene of the environment; separately issuing each geometric primitive of the scene a plurality of times, for each issuance of one of the geometric primitives, shifting the geometric primitive by a sub-pixel offset from a first pixel position to a respective sub-pixel position; and rendering the shifted geometric primitive to generate values for a respective set of pixels for the shifted geometric primitive at the respective sub-pixel position; and combining the values for the respective sets of pixels for the shifted geometric primitive at each of the respective sub-pixel positions to provide values for a resultant set of pixels for the rendered geometric primitive.

Claim 18 recites a method for calculating values for pixels of an image comprising transforming the geometric primitives from a first coordinate space to a second coordinate space; reissuing each geometric primitive for each sampling location of a sampling pattern, each time a geometric primitive is issued, without shifting any of the other transformed geometric primitives, shifting the transformed primitive by a sub-pixel offset from a first pixel

position to a respective sub-pixel position corresponding to a respective one of the sampling locations of the sampling pattern, and rendering the shifted transformed primitive to generate values for a respective set of pixels for the transformed primitive shifted to the respective intermediate image sub-pixel position, and combining the values for the respective sets of pixels of the intermediate images transformed primitive at the respective sub-pixel position to determine values for a resultant set of pixels for the geometric primitive.

The Zhu patent fails to disclose the combination of limitations as recited in claims 1, 10, and 18. For example, the Zhu patent fails to disclose shifting the first transformed primitive in the second coordinate space by first and second sub-pixel offsets from a first pixel position to first and second sub-pixel positions, respectively, without shifting any of the other transformed primitives. As previously discussed, the Zhu patent provides an overview of SST, including binning all geometries in screen space into tiles that geometries intersect. Those primitives that intersect a plurality of tiles are binned in all of the intersecting tiles. Moreover, the Zhu patent fails to disclose combining the values for the first and second sets of pixels for the first transformed primitive to determine values for a resultant set of pixels for the first transformed primitive that are included in the pixels of the image. In contrast, as previously discussed, the Zhu patent describes combining visibility information with the tile geometries for each tile of the SST so that only visible geometries are set up for rasterization.

The Zhu patent further fails to disclose separately issuing each geometric primitive of the scene a plurality of times, where each issuance of one of the geometric primitives, the geometric primitives are shifted by a sub-pixel offset from a first pixel position to a respective sub-pixel position, and the shifted geometric primitive is rendered to generate values for a respective set of pixels for the shifted geometric primitive at the respective sub-pixel position. None of the various anti-aliasing schemes described in the Zhu patent disclose these limitations. For example, the first anti-aliasing scheme described in the Zhu patent directly composites the color contribution of fragments in the color buffer and the second anti-aliasing scheme merges the color contribution from each fragment into one color. The color value is then combined with the value in the corresponding color buffer location.

For the foregoing reasons, claims 1, 10, and 18 are patentably distinct from the Zhu patent. Claims 2-9, which depend from claim 1, claims 11 and 12-17, which depend from claim 10, and claims 19-23, which depend from claim 18 are similarly patentably distinct based

on their dependency from a respective allowable base claim. Therefore, the rejection of claims 1-11 and 13-23 under 35 U.S.C. 102(e) should be withdrawn.

Claims 24 and 33 are also patentably distinct from the Zhu patent because the Zhu patent fails to disclose the combination of limitations recited in the claims.

Claim 24 recites a graphics system that includes a rendering stage coupled to the primitive set-up engine to receive the transformed geometric data for a geometric primitive, the rendering stage configured to separately issue each of the geometric primitives in the new coordinate space a plurality of times, for each issuance of one of the geometric primitives, the rendering stage further configured to shift the geometric primitive a respective sub-pixel offset from a first pixel position to a respective sub-pixel position without shifting any of the other transformed geometric primitives, and calculate values for respective sets of pixels representing the shifted geometric primitive at the respective sub-pixel position, and further includes a buffer coupled to the rendering stage into which the values for the respective sets of pixels calculated by the rendering stage are stored.

Claim 33 recites a graphics system for calculating values for pixels of an image of an environment represented by geometric primitives, the geometric primitives defined by geometric data, the graphics system comprising a multi-stage processing pipeline transforming the geometric data from a first coordinate space to a second coordinate space, and further configured to separately reissue for each geometric primitive for each sampling location of a sampling pattern, each time the geometric primitive is issued, shifting a transformed primitive by a sub-pixel offset from a first pixel position to a respective sub-pixel position corresponding to a respective one of the sampling locations of the sampling pattern and rendering the shifted primitive at the respective sub-pixel position to generate values for a respective set of pixels for the geometric primitive shifted to the respective sub-pixel location, the multi-stage processing pipeline further configured to combine the values for the respective sets of pixels for the geometric primitive shifted to the respective sub-pixel location to determine the values for a resultant set of for the geometric primitive.

The Zhu patent fails to at least disclose a rendering stage that separately issues each of the geometric primitives and shifts the geometric primitive by a respective sub-pixel offset from a first pixel position to a respective sub-pixel position without shifting any of the other transformed geometric primitives. Moreover, the Zhu patent fails to disclose a multi-stage

processing pipeline that separately reissues each geometric primitive for each sampling location of a sampling pattern. Nor does the Zhu patent disclose a multi-stage processing pipeline that shifts a transformed primitive by a sub-pixel offset from a first pixel position to a respective sub-pixel position corresponding to a respective one of the sampling locations of the sampling pattern. As previously discussed, the Zhu patent describes, among other things, an anti-aliasing method utilizing two different anti-aliasing schemes that switch when the number of fragments that are stored in the multipass buffer exceed a limit. In response, multi-pass merging is deactivated and the fragments are combined in the color buffer. A first anti-aliasing scheme is utilized after the number of fragments fills the multipass buffer, before which a second anti-aliasing scheme is utilized.

For the foregoing reasons, claims 24 and 33 are patentably distinct from the Zhu patent. Claims 25-32, which depend from claim 24, and claims 34-36, which depend from claim 33, are similarly patentably distinct based on their dependency from an allowable base claim. Therefore, the rejection of claims 24-36 under 35 U.S.C. 102(e) should be withdrawn.

All of the claims pending in the present application are in condition for allowance. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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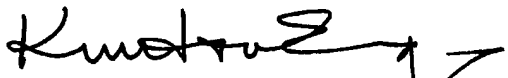

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